



## **Summary of Fishery Surveys**

### **North Spirit and Spirit Lakes, Price and Taylor Counties, 2015-2016**

WDNR's Fisheries Management Team from Park Falls completed fyke netting and electrofishing surveys in 2015–2016 to assess the status of important fish populations in North Spirit Lake and Spirit Lake. Fall electrofishing evaluated natural recruitment of young-of-the-year walleyes. Fyke netting in October yielded useful information on black crappies. Fyke nets set shortly after the spring thaw targeted walleye, muskellunge, northern pike, and yellow perch and provided complementary information on black crappies and bluegills in Spirit Lake. Electrofishing in late spring documented the abundance and size structure of largemouth bass and bluegill populations. Quality, preferred, and memorable sizes referenced in this summary are based on standard proportions of world record lengths developed for each species by the American Fisheries Society. “Keeper size” is our own description applied to bluegill  $\geq 7$  inches long and black crappie  $\geq 9$  inches long, based on known angler behavior.

### **Survey Effort**

On September 23<sup>rd</sup>, 2015, when the water temperature was 67°F, we sampled 2.00 miles of Spirit Lake's shoreline in 0.97 electrofishing hours. On that same night we applied identical electrofishing effort (distance and time) to North Spirit Lake. A severe algae bloom limited our ability to see and capture fish deeper than one foot. On October 12<sup>th</sup>, 2015 we set four fyke nets in North Spirit and four nets in Spirit Lake and fished them overnight for two nights, totaling eight net-nights of survey effort in each lake. Water temperatures ranged 54–57°F. On April 11<sup>th</sup>, 2016, when water temperatures averaged 38°F, we set four fyke nets in Spirit Lake and fished them overnight for four nights, tending them daily. One net collapsed and did not fish well over one night, so we reduced our survey effort to 15 net-nights. On April 15<sup>th</sup>, 2016, the ice had receded enough for us to move four fyke nets from Spirit Lake to North Spirit Lake. They fished three consecutive nights when water temperature was in the mid-40°F range, before we tallied the combined catch from 12 net-nights of netting effort. On May 23<sup>rd</sup>, 2016 we completed an electrofishing circuit of Spirit Lake's entire shoreline. We sampled 2.11 miles in 0.90 hours, including 0.55 miles sub-sampled for all species in 0.25 hour. That night we also completed our late spring electrofishing survey on North Spirit Lake, sampling 1.96 shoreline miles in 0.97 hours, including 0.46 mile sub-sampled for all species in 0.23 hour. Water temperature averaged 67°F in both lakes—within the range recommended to represent the status of the targeted populations during their pre-spawning and peak spawning activities. Water clarity and fish visibility in late spring were much better than in fall. Nonetheless, fish stunned deeper than we could retrieve decreased our electrofishing capture efficiency in several long, near-vertical segments of North Spirit Lake's shoreline.

## Habitat Characteristics

Near the headwaters of the Spirit River watershed, an unnamed stream drains from Hultman and Stone lakes and joins the narrow connection between North Spirit Lake and Spirit Lake, located about seven miles northeast of Rib Lake, WI. A fixed-crest dam on the outlet of Spirit Lake raises the impoundment level about 3 feet above the natural condition and releases an average flow of 8.2 cubic feet per second to the Spirit River. With no gates or sluiceways the dam offers no capability to manipulate water levels. North Spirit Lake (also known as Big Spirit Lake) covers 213 acres with a maximum depth of 22 feet and an average depth of 12 feet. The substrate is 90% gravel and 10% muck. Spirit Lake (also known as Little Spirit Lake) has a surface area of 126 acres, a maximum depth of 9 feet, and an average depth of 6 feet. Lakebed materials are 65% gravel, 20% muck, and 15% sand. High nutrient concentrations and low water clarity (Secchi depth = 3.5–5.5 feet in August) prompt us to classify both lakes as eutrophic. Both experience dense algae blooms in late summer that sometimes persist through September. Spirit Lake, having more shallow area where light can penetrate to fine substrate, produces submergent vegetation in higher stand density than North Spirit Lake, which has steeper shorelines and less aquatic vegetation.

Every year in late winter Spirit Lakes Improvement Association operates an aerator on each lake to reduce the chance of severe “fish winterkill,” which can happen when decomposing plant material depletes dissolved oxygen in the ice-covered season. In February 2010, the channel connecting the two lakes was dredged to improve navigation. A public boat landing with a dock and parking lot is located on the south shore of Spirit Lake and maintained by the Town of Rib Lake.

## Summary of Results

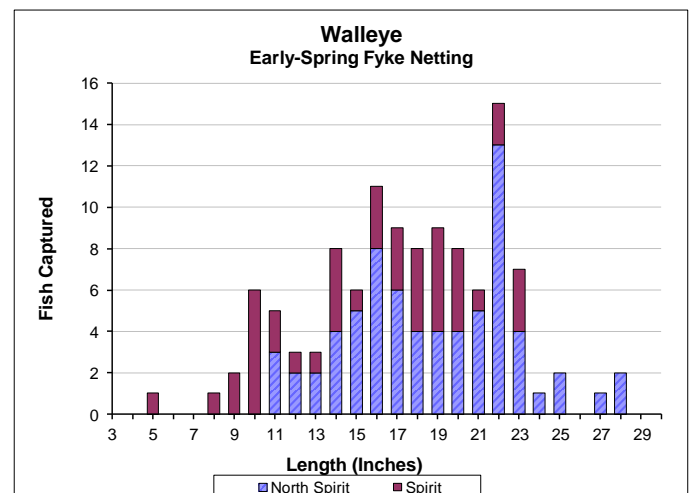
We captured 13 fish species in our netting and electrofishing surveys. Largemouth bass, muskellunge, and walleyes were the principal predators. Bluegills were the most common panfish, but black crappies and yellow perch were also present in lower numbers. Golden shiners and white suckers complemented the forage base.

### Walleye



Early Spring Fyke Nets

	Number per net-night $\geq 10"$	Quality Size $\geq 15"$	Preferred Size $\geq 20"$	Memorable Size $\geq 25"$
North Spirit	5.8	84%	46%	7%
Spirit	2.7	65%	25%	0%
Combined	4.1	77%	38%	5%



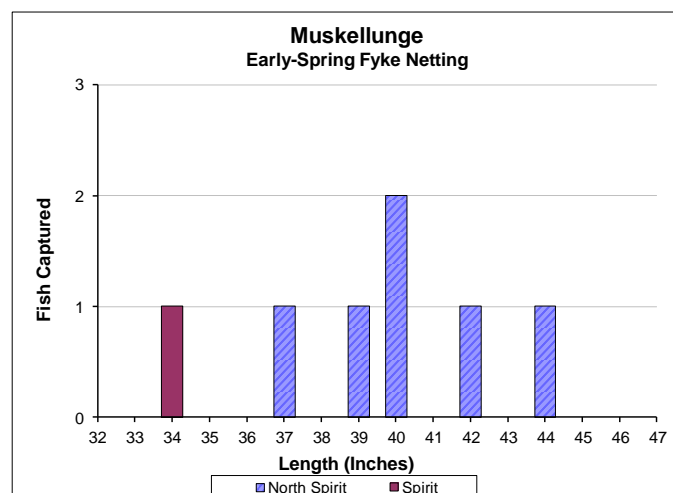
Our low capture rate of walleye in early spring 2016 fyke nets suggests low adult population abundance. Unlike in our 2009 survey when nets captured only walleye longer than 21 inches, walleye length was widely distributed from 8 to 28.5 inches, revealing a population now comprised of several age classes. Our fall 2015 electrofishing surveys documented no natural recruitment—that is, if any young walleyes were hatched in these lakes in spring 2015, they did not survive, grow, and contribute to the adult population. However, fall electrofishing did demonstrate the survival and growth of walleyes stocked as large fingerlings in 2014. We captured 4.5 and 6 yearlings/mile in Spirit and North Spirit lakes. Examination of their scales showed that stocked walleyes averaged 9.5 inches in Spirit Lake (n = 9; range 8.8–10.3) and 10.2 inches in North Spirit Lake (n = 8; range 9.5–10.9) after growing one season in the hatchery and another season in these lakes. In North Spirit Lake scales from four walleyes showed growth to 11.1 inches (range 10.7–11.5) in three summers. In the absence of successful and reliable natural reproduction, walleye recruitment has historically been maintained by stocking. In 1988-1996 and 2001-2004 WDNR planted small walleye fingerlings (1.3–3.6 inches) annually into North Spirit Lake and once into Spirit Lake in 2000. In 2006-2008 local sportsman’s groups purchased and stocked large fingerling walleyes in North Spirit Lake with the WDNR approval. The Rib Lake Area Fish and Game Association, with support from neighboring sportsmen’s organizations and WDNR, has reared and stocked large fingerling walleyes annually in 2009-2016 in both North Spirit and Spirit Lakes at variable rates of about 4-7 fish per acre. Stocking walleyes regularly at a larger size appears to maintain enough juveniles and adults to supplement predatory control on panfish abundance and improve bluegill and black crappie size structure. In May 2015 WDNR rescinded the special harvest regulation that allowed harvest of young walleye under no minimum length limit, protected walleyes 14–18 inches long, and permitted anglers to keep only one walleye over 18 inches in these lakes. In its place is the standard walleye fishing regulation currently in effect on most water within Wisconsin’s Ceded Territory. Anglers may keep a daily bag limit of 3 walleye from 15 inches but less than 20 inches long, except one walleye may be over 24 inches.

## Muskellunge



Early Spring Fyke Nets

	Number per net-night $\geq 20''$	Quality Size $\geq 30''$	Preferred Size $\geq 38''$	Memorable Size $\geq 42''$
North Spirit	0.5	100%	83%	33%
Spirit	0.1	100%	0%	0%
Combined	0.3	100%	71%	29%



Comparing spring fyke netting surveys in 2009 and 2016, our catch rate of muskellunge decreased by a factor of 13 in both Spirit and North Spirit lakes. Some of the difference might be explained, if the earlier timing and lower average water temperature in our recent survey (April 11-18, 2016; 42°F) did not mimic ideal musky spawning conditions (50-55°F) as well as they did in the last survey (April 23-24, 2009; 46°F). Based on average water temperatures, both surveys occurred before adult muskellunge

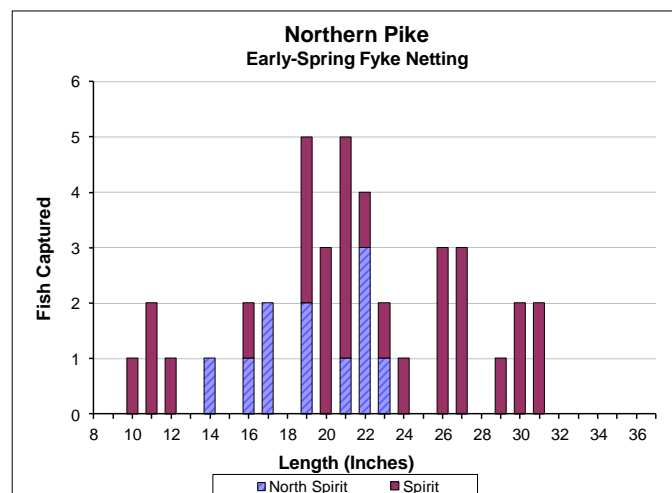
move and gather to spawn. Yet, our 2009 catch rate of 6.5 muskellunge per net-night in North Spirit Lake ranked in the 95th percentile among class A2 (action) musky waters. Addition of new recruits to the musky population in both lakes has been maintained by stocking large fingerlings. Concerned that high adult abundance might lead to intense food competition and impaired growth, WDNR temporarily suspended musky stocking in 2009. Despite the uncertainty related to the timing of our spring surveys, the substantial change in netting catch rate suggests that muskellunge population abundance has decreased over seven years toward a healthier level that can optimize available food, grow at a satisfactory rate, and produce memorable-size fish. After hearing reports that avid musky anglers were encountering few young muskies < 30 inches long, in 2014 and 2015 WDNR approved applications from Central Wisconsin Chapter, Muskies, Inc. to purchase and stock muskellunge at a rate of 0.25 large fingerlings per acre. Adhering to WDNR Fishery Management policy, we will no longer approve permit applications to stock muskellunge into Spirit Lakes and other waters within the native range of the species because private producers cannot meet brood stock management protocols for genetic conservation. Instead, to resume and maintain recruitment to the population we will go back to stocking muskellunge produced in WDNR hatcheries that follow those brood stock management guidelines. Beginning again in 2017, both Spirit Lakes will receive young muskellunge about 12 inches long stocked at rate of 0.5 large fingerling/acre in alternate years. Musky harvest follows the standard regulation in the Northern Zone with an open season from the last Saturday in May to November 30 and a daily bag limit of one fish at least 40 inches long. We believe angling harvest of muskellunge is negligible in these lakes.

## Northern Pike



Early Spring Fyke Nets

	Number per net-night $\geq 14"$	Quality Size $\geq 21"$	Preferred Size $\geq 28"$	Memorable Size $\geq 34"$
North Spirit	0.9	45%	0%	0%
Spirit	1.7	72%	20%	0%
Combined	1.3	64%	14%	0%



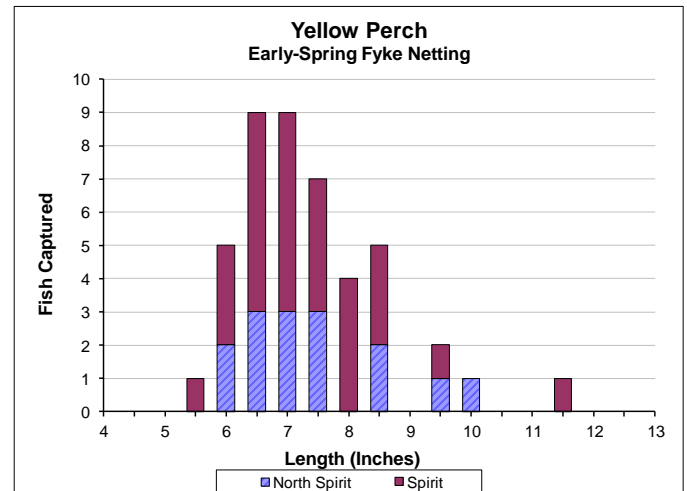
Early spring fyke nets captured more northern pike in 2016 than in 2009 when they caught only four, but our netting catch rates in both lakes were still low, and we do not believe the change represents a sizeable increase in pike abundance. At water temperature 37–44°F our Spirit Lake netting survey was well timed to capture spawning pike, but with water already at 52°F on the final day of our survey in North Spirit Lake we may have missed peak activity as pike usually spawn soon after and sometimes before the ice thaws. Because large females are often captured early and disperse quickly in the spawning period, our late measure of population size structure in North Spirit Lake may be skewed toward the smaller males. In Spirit Lake, where netting coincided with the pike spawning peak, one in five pike in our sample had attained preferred size 28 inches or longer. It is unlikely that Spirit Lake produces large pike and North Spirit Lake does not when both have such high rates of biological productivity that can grow muskellunge to memorable size.

## Yellow Perch



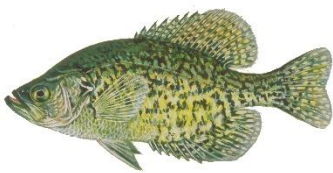
Early Spring Fyke Netting

	Number per net-night $\geq 5"$	Quality Size $\geq 8"$	Preferred Size $\geq 10"$
North Spirit	1.4	27%	7%
Spirit	1.5	31%	3%
Combined	1.5	30%	5%



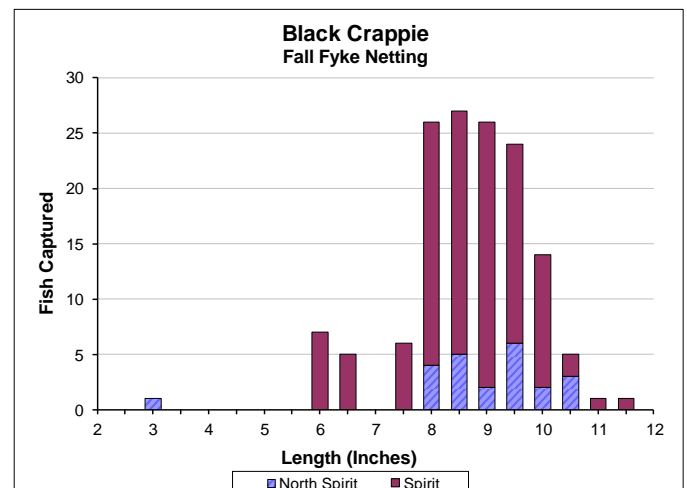
In Spirit Lake our catch rate of yellow perch 5 inches or longer in early spring 2016 fyke nets plummeted from 76 perch per net-night in 2009. The same comparison also decreased in North Spirit, though less drastically, from 6.8 per net-night. In 2009 fyke nets in Spirit Lake captured perch at eleven times the rate they did in North Spirit Lake, but in 2016 the perch catch per net-night was nearly identical in both lakes. This apparent decline in perch abundance may stem from the steady influx of walleyes stocked annually since 2006. The walleye population's increasing demand for small forage, including young perch (their favorite food), has undoubtedly diminished the rate at which the perch population can replenish the individuals that die from angling and natural causes. Yellow perch hold a pivotal role in structuring the fish community as they are also the preferred food of largemouth bass, muskellunge, and northern pike. By adjusting stocking rates toward moderate predator abundance, we will continue to manage the perch population as a reliable food source for important sportfish populations, rather than as tasty fare for anglers. Presently though, patient panfish anglers can enjoy decent perch fishing on Spirit Lakes. With the decline in perch numbers their size structure has improved noticeably since 2009 when only 1% of the perch were 8 inches or longer.

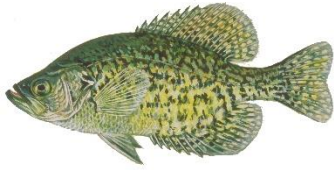
## Black Crappie



Fall Fyke Nets

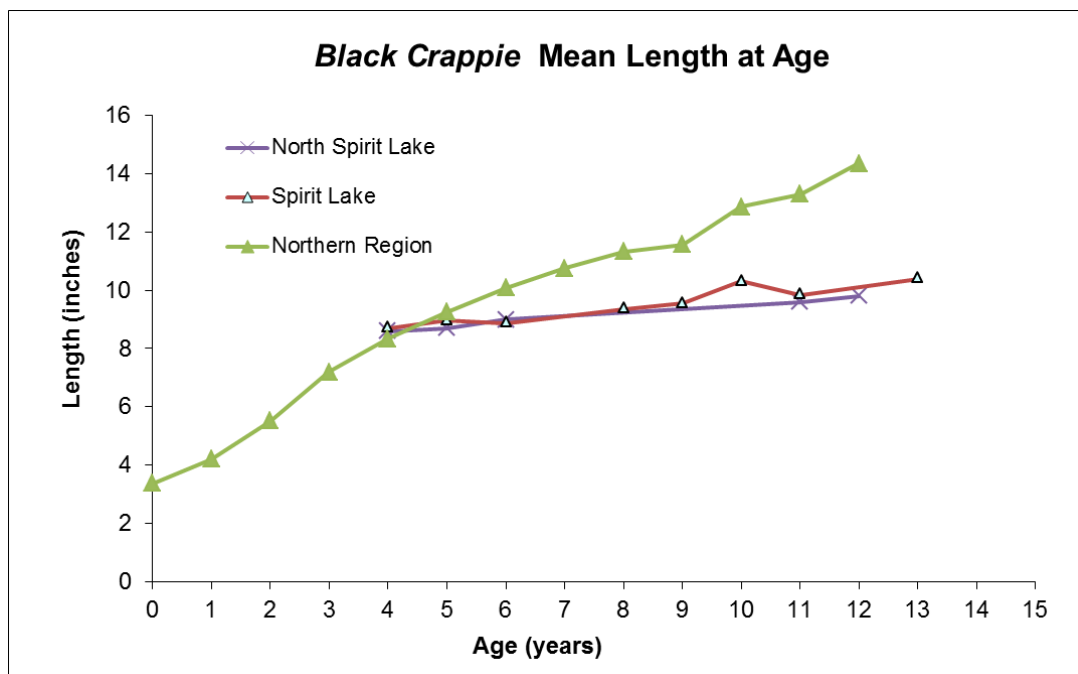
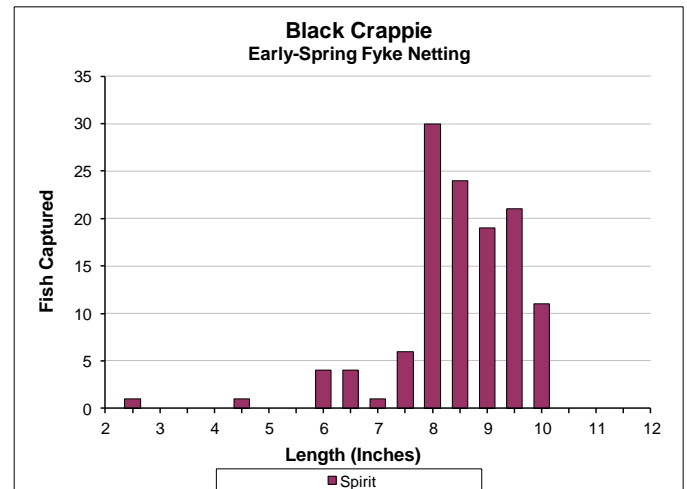
	Number per net-night $\geq 5"$	Quality Size $\geq 8"$	Preferred Size $\geq 10"$	Memorable Size $\geq 12"$
North Spirit	2.8	100%	23%	0%
Spirit	15	85%	13%	0%
Combined	8.9	87%	15%	0%





Early Spring Fyke Nets

Captured 6.5 per net-night $\geq 5$ "	
Quality Size $\geq 8$ "	88%
Preferred Size $\geq 10$ "	9%
Memorable Size $\geq 12$ "	0%



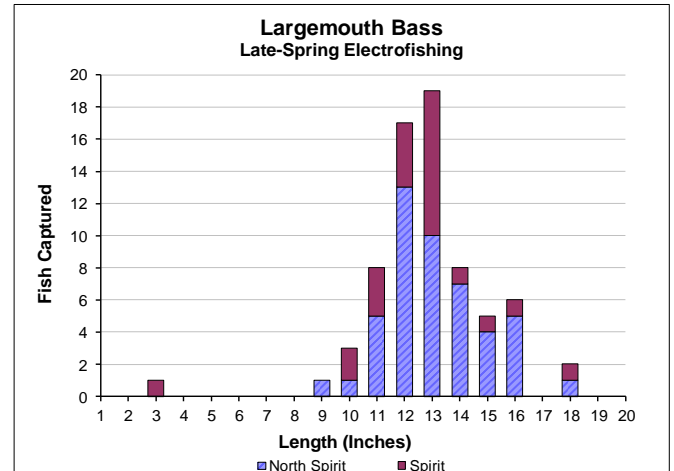
Our capture rates of black crappies in fall 2015 fyke nets suggest that population abundance in Spirit Lake was over five times higher than in North Spirit Lake, compared to fall 2008 when the catch per net-night was similar in both lakes. Early spring 2016 nets in Spirit Lake reaffirmed our assessment of low to moderate crappie abundance—we did not count panfish in spring nets in North Spirit Lake. At lower abundance the North Spirit Lake population had a slightly higher proportion of preferred-size crappies  $\geq 10$  inches than Spirit Lake’s population. Overall, size structure improved considerably since our 2008-2009 surveys when we found very few keeper-size crappies longer than 9 inches. In pooled samples from both lakes, the average length of age-4 crappies increased from 7.4 inches (range 7.0 – 7.9,  $n=20$ , scales) in 2008 to 8.6 inches (range 8.5–8.8,  $n=4$ , otoliths) in 2015, compared to the regional average length of 8.3 inches at age 4. However, at ages 5–13 crappies grew progressively slower and slower, reaching only 9.7 inches at age 11 (range 9.0–10.1,  $n=12$ , otoliths) when regionally crappies were 3.6 inches longer. Most preferred-size crappies in our samples were the slow-growing survivors of the strong 2004 year class whose longevity eventually resulted in the sizes that anglers like to keep.

## Largemouth Bass



### Late Spring Electrofishing

	Number per mile $\geq 8''$	Number per hour $\geq 8''$	Quality Size $\geq 12''$	Legal Size $\geq 14''$	Preferred Size $\geq 15''$
North Spirit	24	48	85%	36%	21%
Spirit	10	24	77%	18%	14%
Combined	17	37	83%	30%	19%



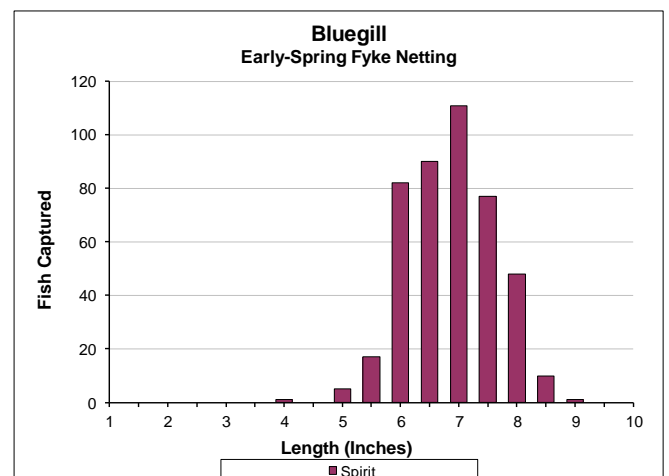
The capture rates and length distribution of largemouth bass recorded in our late spring electrofishing surveys show that the combined population in Spirit and North Spirit Lake has maintained moderate abundance and satisfactory size structure since the last assessment in 2009. Just like in 2009, we again captured twice as many bass per electrofishing hour in North Spirit Lake as we did in Spirit Lake. Despite higher bass abundance in 2016, North Spirit Lake had twice the proportion of legal-size bass compared to Spirit Lake, whereas 83% of Spirit Lake bass and 36% of North Spirit Lake bass were  $\geq 14$  inches long in 2009. In past efforts to increase largemouth bass abundance, small and large fingerlings were stocked into Spirit Lake at two- or three-year frequency in 1984–2001, but since then natural reproduction is the only source for replenishing the population in both lakes. Predation by and competition with walleye, pike, and muskellunge should continue to foster a moderate recruitment rate, a satisfactory growth rate, and a respectable share of preferred-size bass for anglers to catch or keep. We suspect that in these productive lakes the bass population has more large fish than our recent samples revealed. No smallmouth bass were found in our samples.

## Bluegill



### Early-Spring Netting

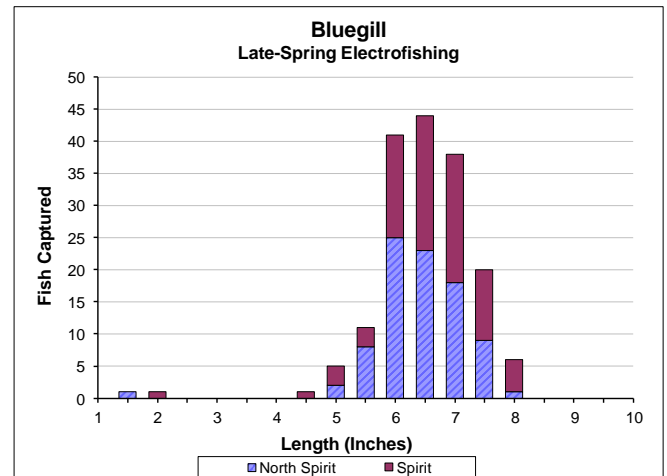
Captured 31 per net-night $\geq 3''$	
Quality Size $\geq 6''$	95%
Keeper Size $\geq 7''$	56%
Preferred Size $\geq 8''$	13%





### Late-Spring Electrofishing

	Number per mile $\geq 3''$	Number per hour $\geq 3''$	Quality Size $\geq 6''$	Keeper Size $\geq 7''$	Preferred Size $\geq 8''$
North Spirit	187	374	88%	33%	1%
Spirit	145	320	91%	45%	6%
Combined	164	346	90%	39%	4%



Our recent electrofishing surveys imply that bluegill abundance was moderately high and their size structure was similar in both lakes. Electrofishing captured North Spirit Lake bluegills at nearly identical rates in spring 2009 and 2016, but in Spirit Lake the electrofishing catch rate, our measure of bluegill abundance, decreased by 54% in that period. Proportions of keeper- and preferred-size bluegill increased substantially from 2009 when only 0.5% of bluegills captured by electrofishing in North Spirit Lake and 3% in Spirit Lake were 7 inches or longer and none were 8 inches long. Samples from fyke nets often have higher proportions of large bluegills that go undetected in electrofishing surveys. We did not measure bluegills from early spring netting on North Spirit Lake, but in Spirit Lake 13% of bluegills in spring nets and 10% in fall nets were at least 8 inches long. We did not analyze scales or bony parts to confidently assess bluegill growth rate, but we suspect that the added predatory pressure from stocked walleyes helped to moderate the high bluegill abundance that we noted in our 2009 surveys. With less crowding and food competition bluegill are probably now growing near the regional average rate and surviving long enough to produce favorable shares of keeper- and preferred-size fish that should satisfy most panfish anglers who want to catch a meal.

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NORTH SPIRIT

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